Summary of various GOES sounder data, products, and uses

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in collaboration with the

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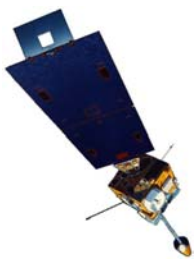
Madison, WI

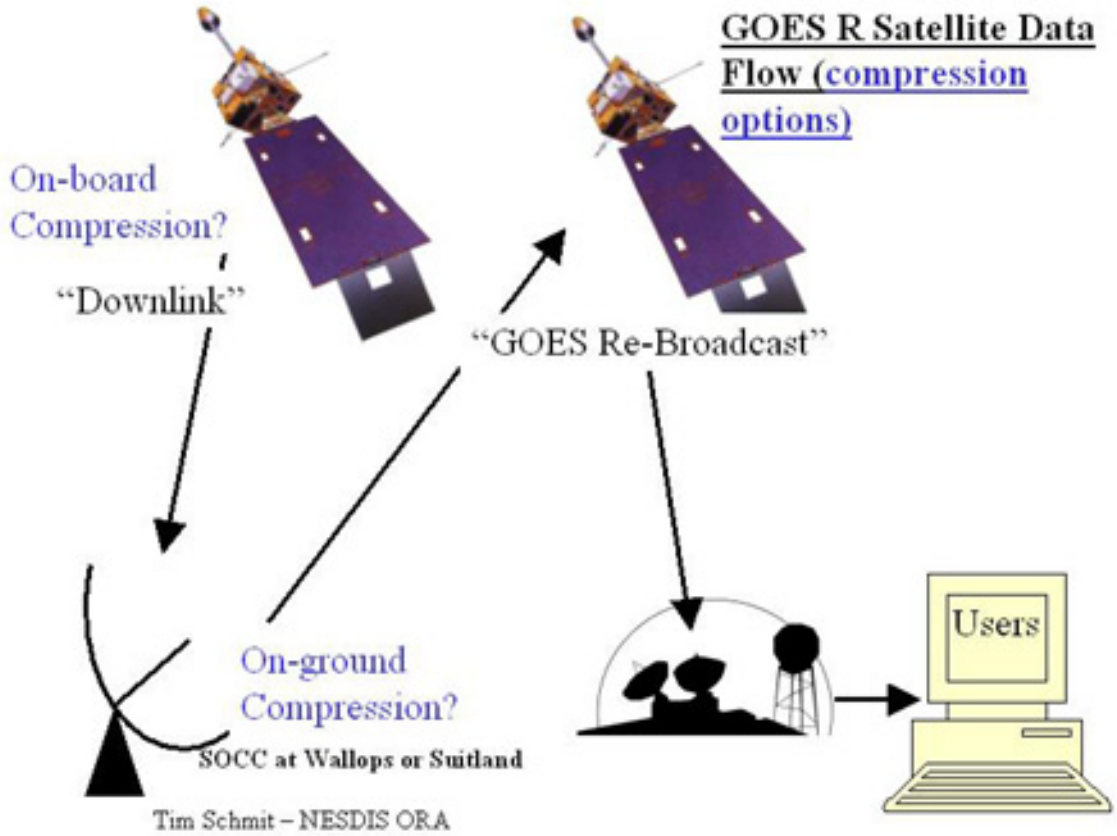
- GOES-R Data Flow
- Current GOES Sounder
- Intro high-spectral resolution



May 22, 2003

UW-Madison

From first data compression meeting:



2 locations for compression, **on-board** or **on-ground**
(these have very different constraints – memory, processing, etc)

What *may* be in the GOES Re-Broadcast (GRB)?

- Subset (spectrally or temporally) of Imager radiances
- Subset (spectral sampling or "super-channels" of HES radiances
- Subset of derived products (retrievals, cloud mask, DPI, etc.)
- Nothing (distribute via other means)

Or

- As much radiance information that can be compressed into the available re-broadcast bandwidth. This may use a range of compression techniques. The compression ratios would differ for the various bands of the ABI and the high-spectral resolution data. The uncompressed data could be made available via "land" distribution methods.

Some uses of the **current GOES Sounder**

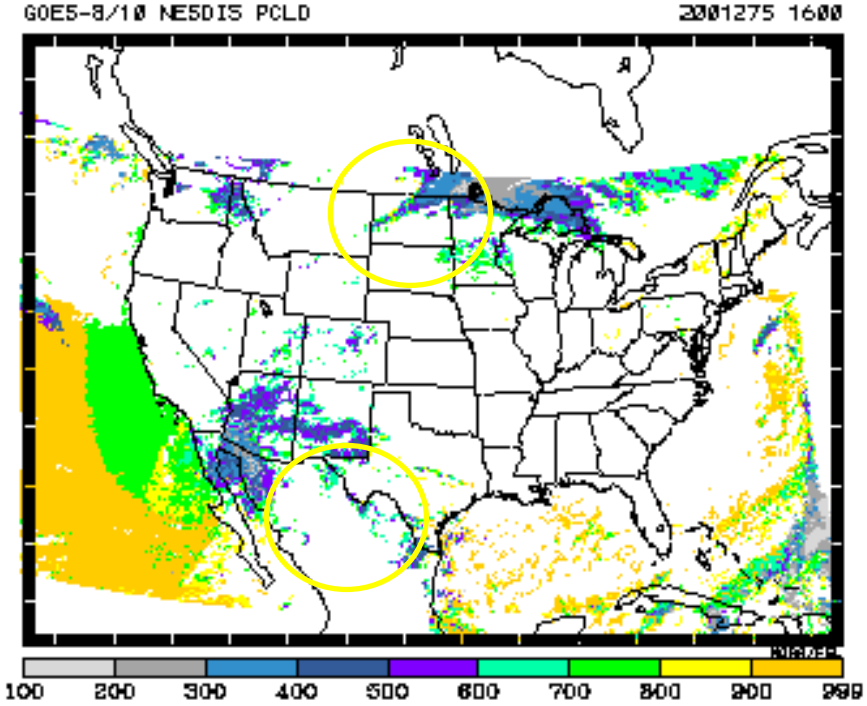
NWP (Numerical Weather Prediction):

- Clear-sky radiances (Global, Eta)
- Precipitable water layers (CRAS, RUC, Eta)
- Cloud-top information (CRAS, RUC)
- Winds (NOGAPS)

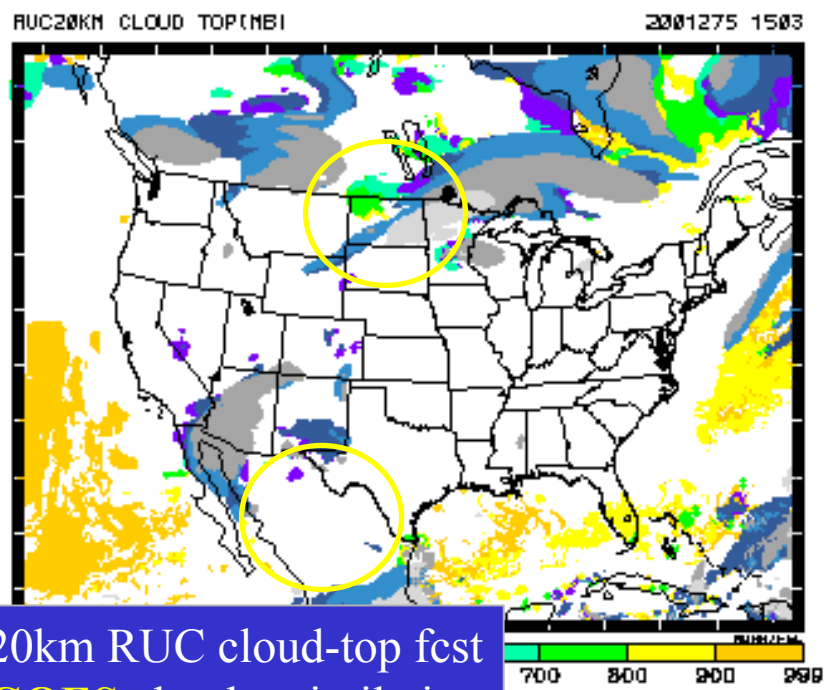
Nowcasting/short-term forecasting:

TPW	Skin Temperature
Lifted Index	CAPE
Total Ozone	Images
Cloud Height	Effective Cloud Amount

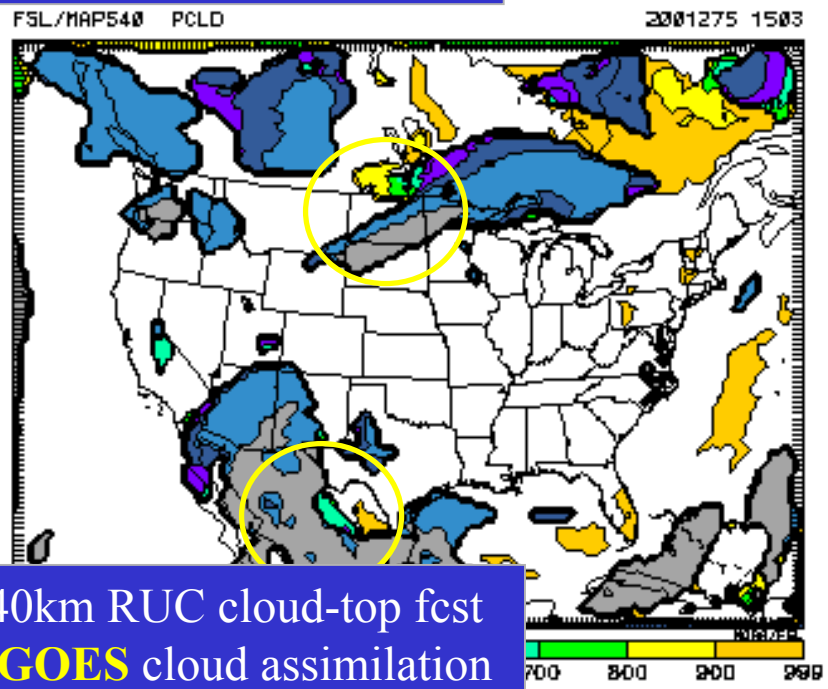
The range of uses will dramatically increase with the improved spatial, spectral and temporal coverage of the HES-IR.



Verification
Cloud-top pressure
based on NESDIS product



3h 20km RUC cloud-top fcst
w/ GOES cloud assimilation



3h 40km RUC cloud-top fcst
No GOES cloud assimilation

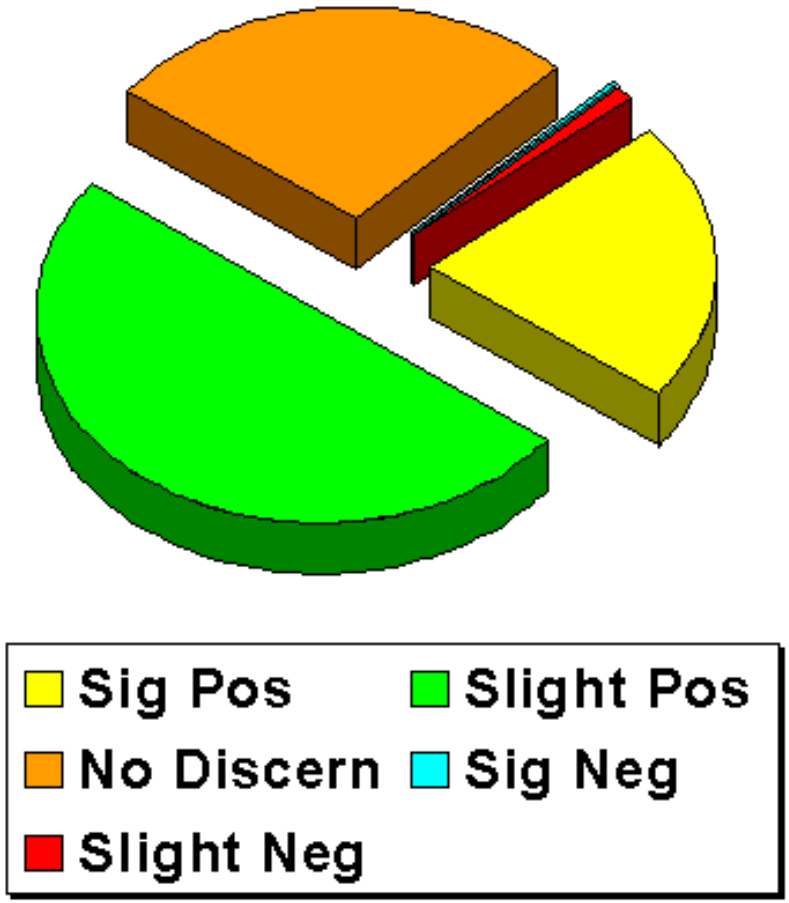
Effect of GOES (sounder cloud) data on 3-h RUC cloud **forecasts**

"much improved cloud forecasts"

Stan Benjamin – NOAA/FSL

1800 UTC
Tues 2 Oct 2001

NWS Forecast Office Assessment of GOES Sounder Total Precipitable Water

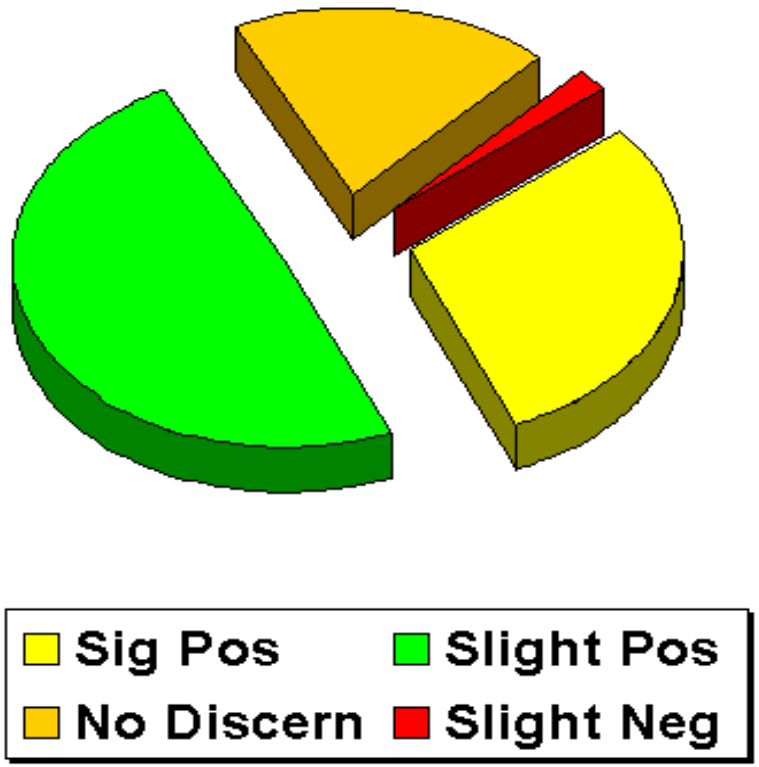


Summer 99 Forecaster assessment of usefulness of changes in hourly TPW product for precipitation forecast

Out of 207 weather cases.
- Significant Positive Impact (21.3%)
- Slight Positive Impact (50.2%)
- No Discernible Impact (27%)
- Slight Negative Impact (1%)
- Significant Negative Impact (<1%)

Figure from the National Weather Service, Office of Services

NWS Forecast Office Assessment of GOES Sounder Atmospheric Instability

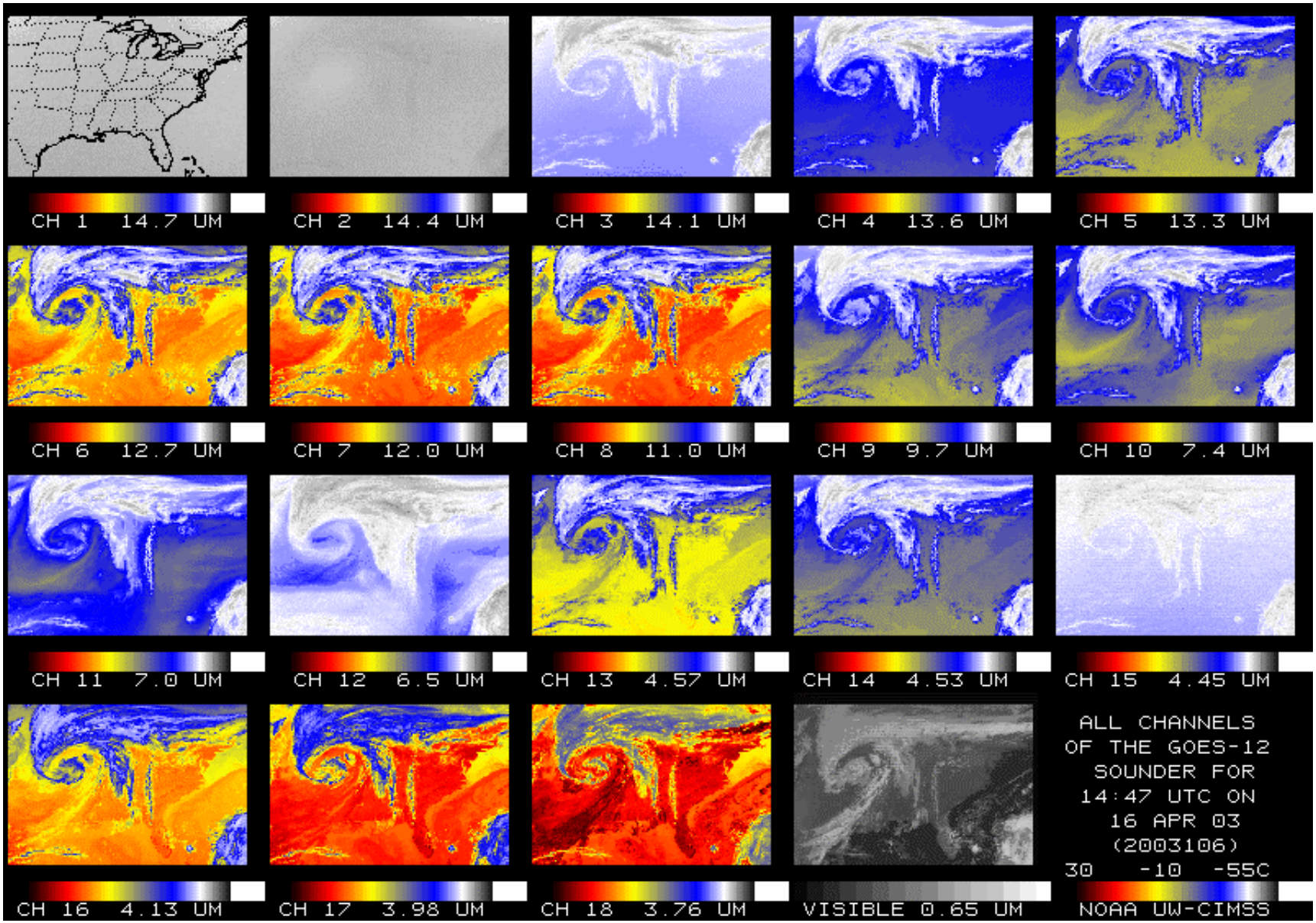


Summer 99 Forecaster assessment of usefulness of changes in hourly LI, CAPE, & CINH product for predicting location/timing of thunderstorms

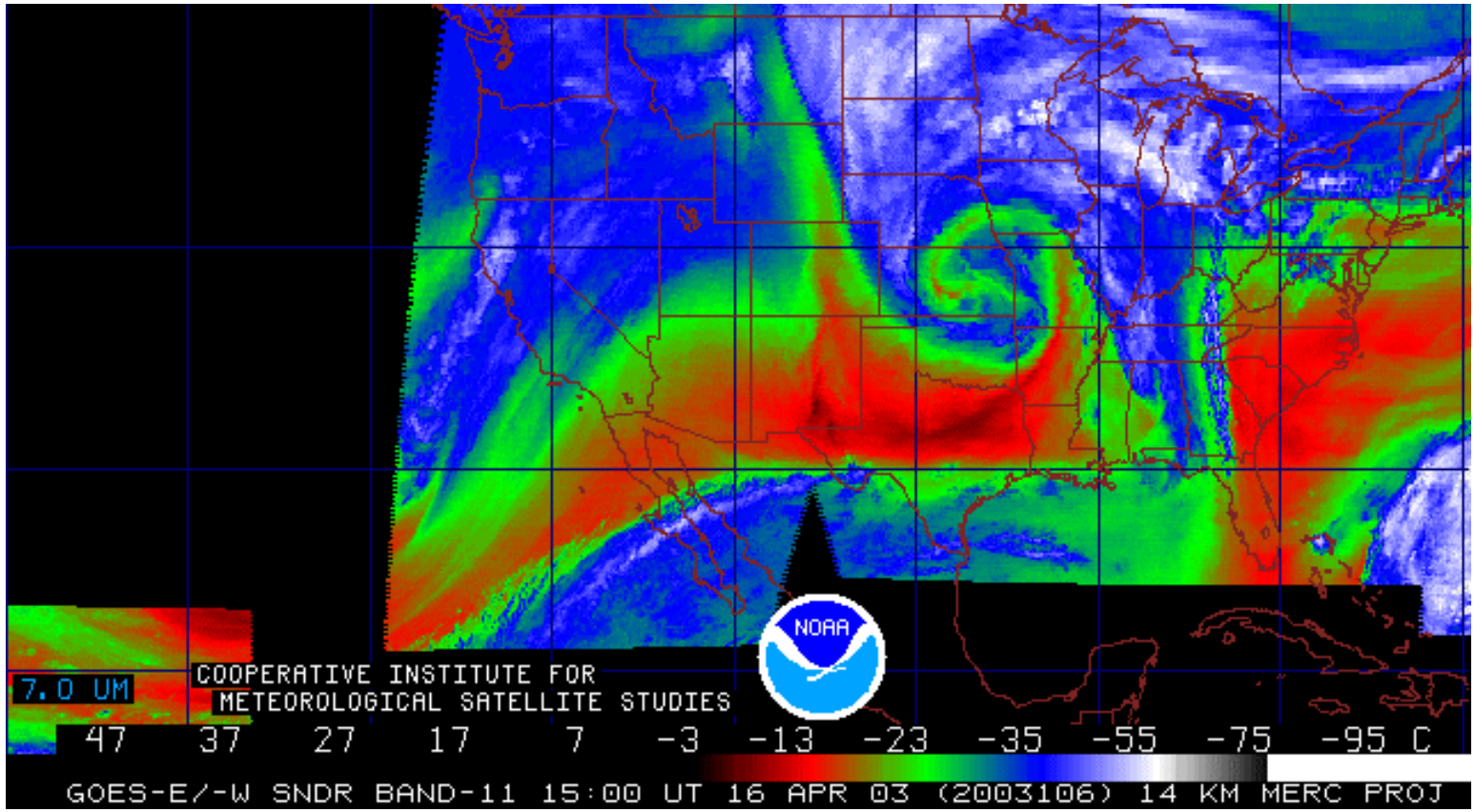
There were 248 valid weather cases.
- Significant Positive Impact (30%)
- Slight Positive Impact (49%)
- No Discernible Impact (19%)
- Slight Negative Impact (2%)
- Significant Negative Impact (0)

Figure from the National Weather Service, Office of Services

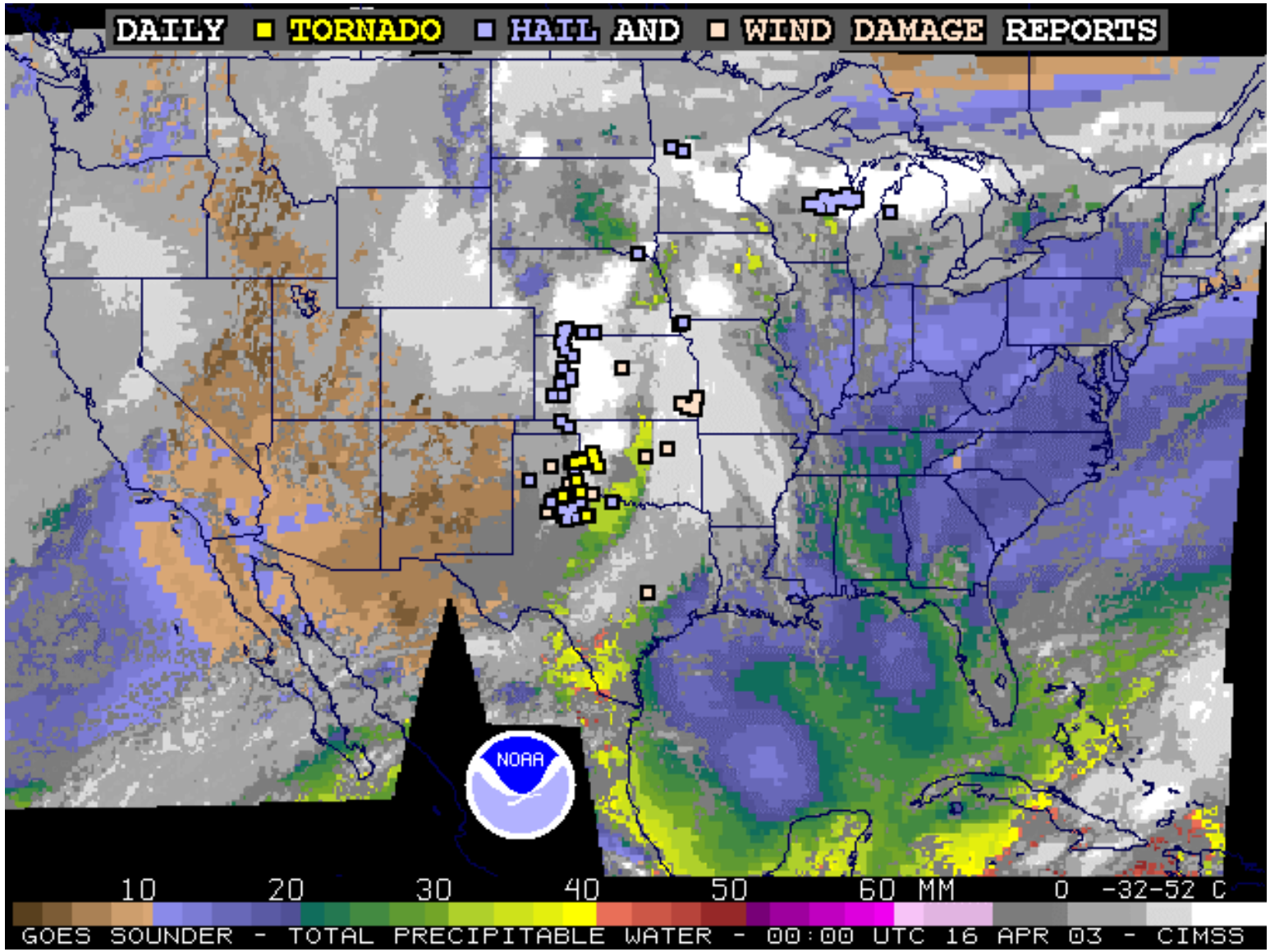
GOES Sounder Spectral Bands: 14.7 to 3.7 um & Vis



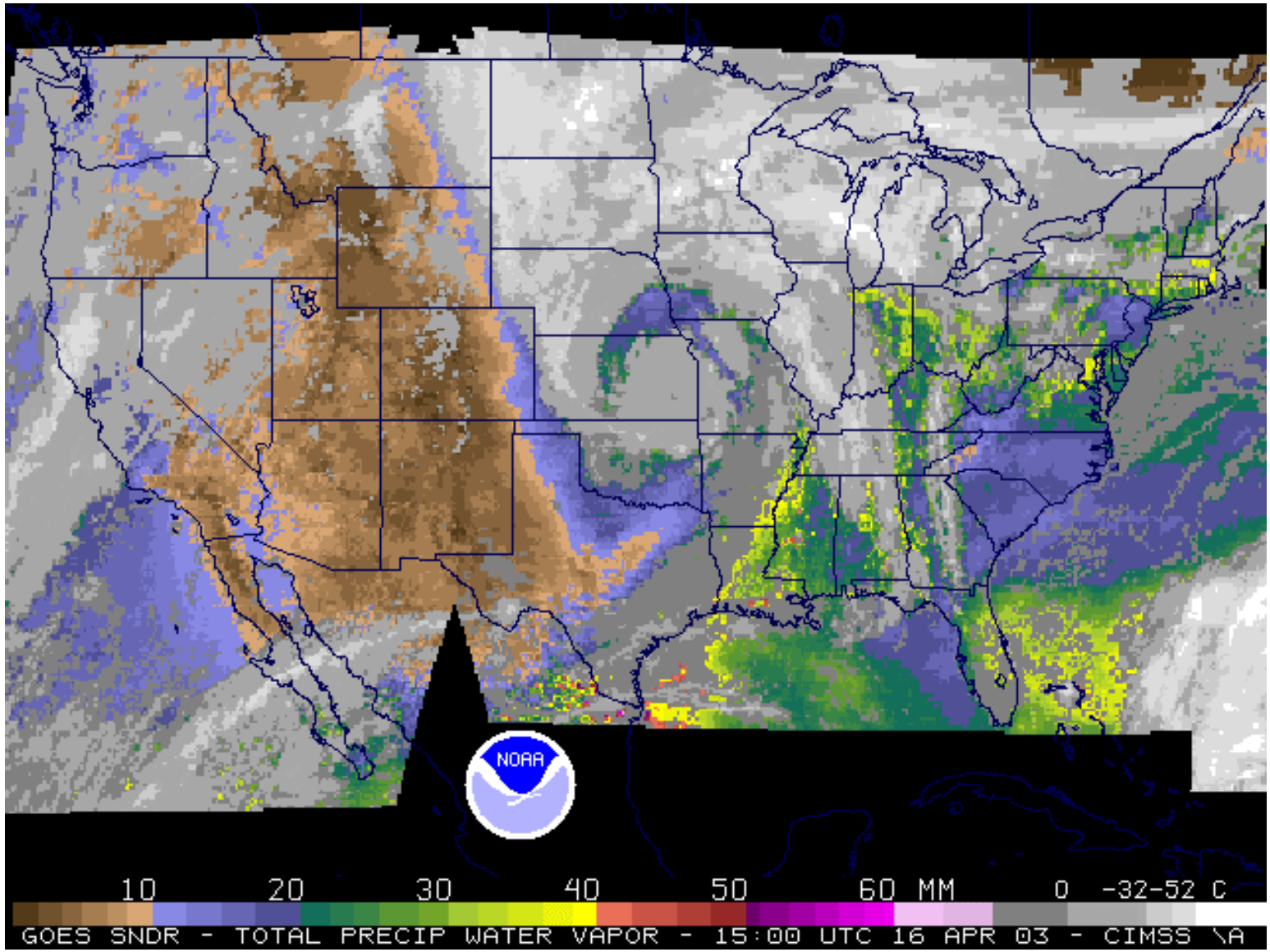
GOES Sounder Spectral Band: 7 um



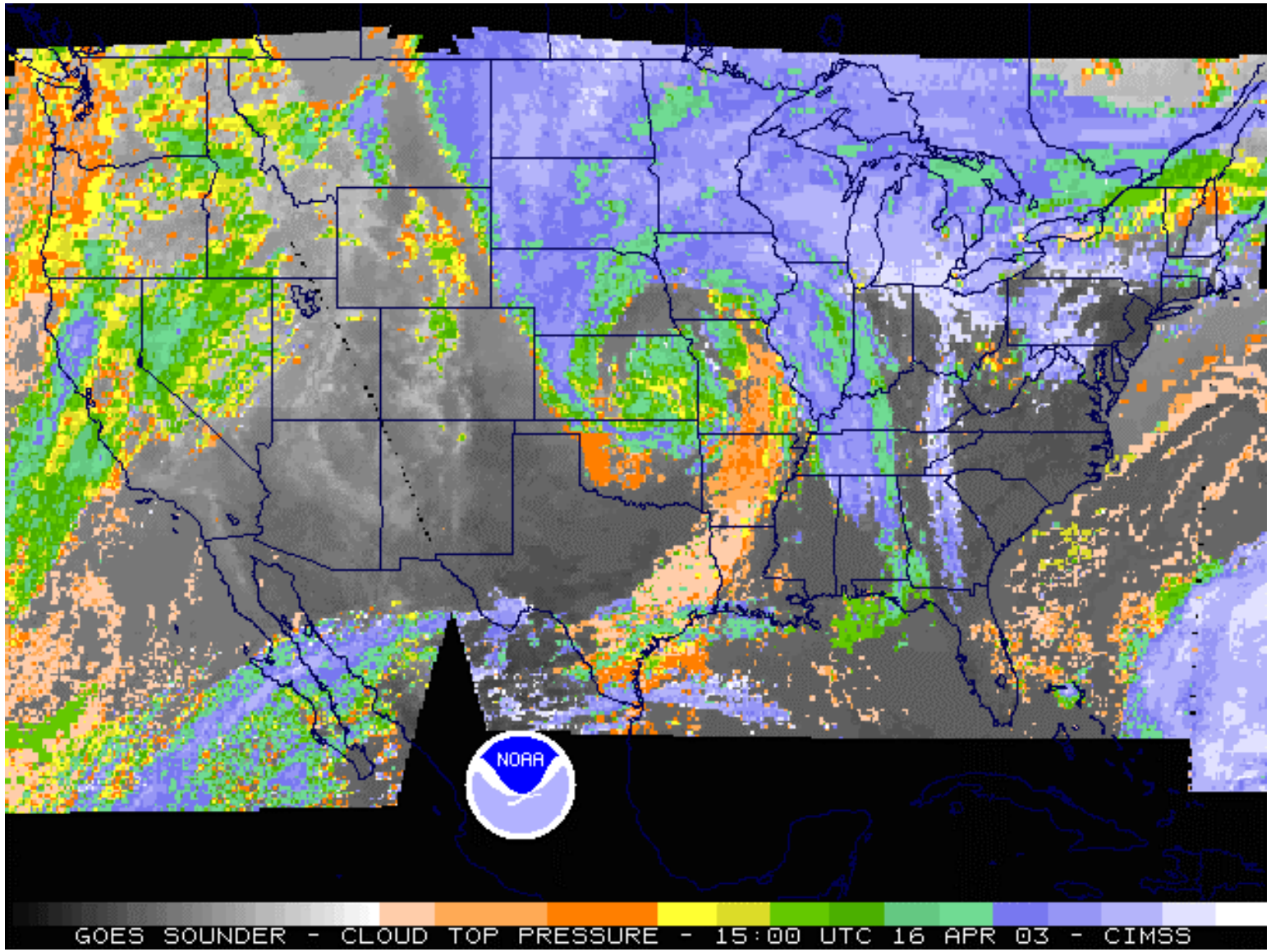
GOES Sounder TPW and Severe Weather Plots



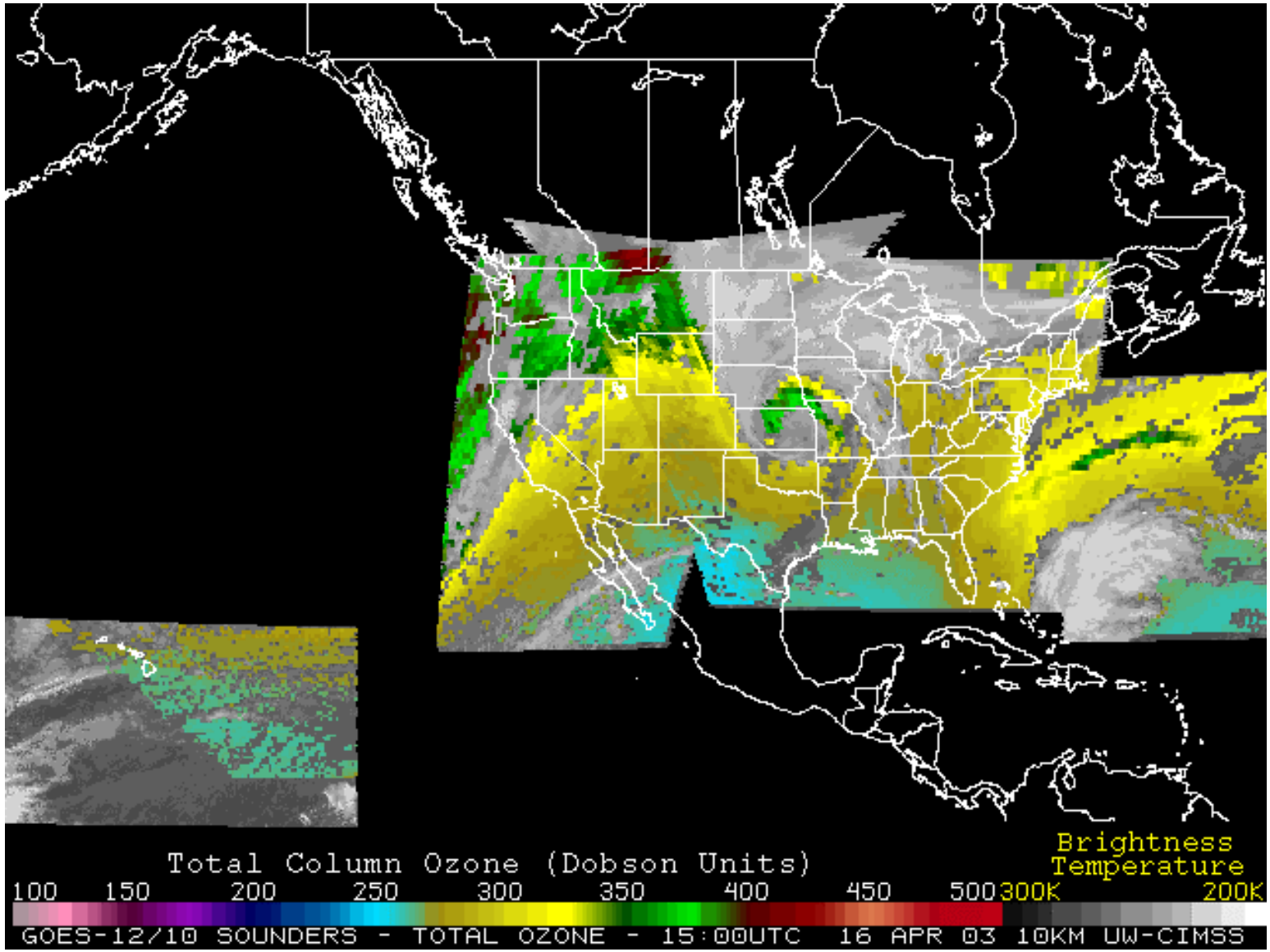
GOES Sounder TPW



GOES Sounder Cloud-top Pressure

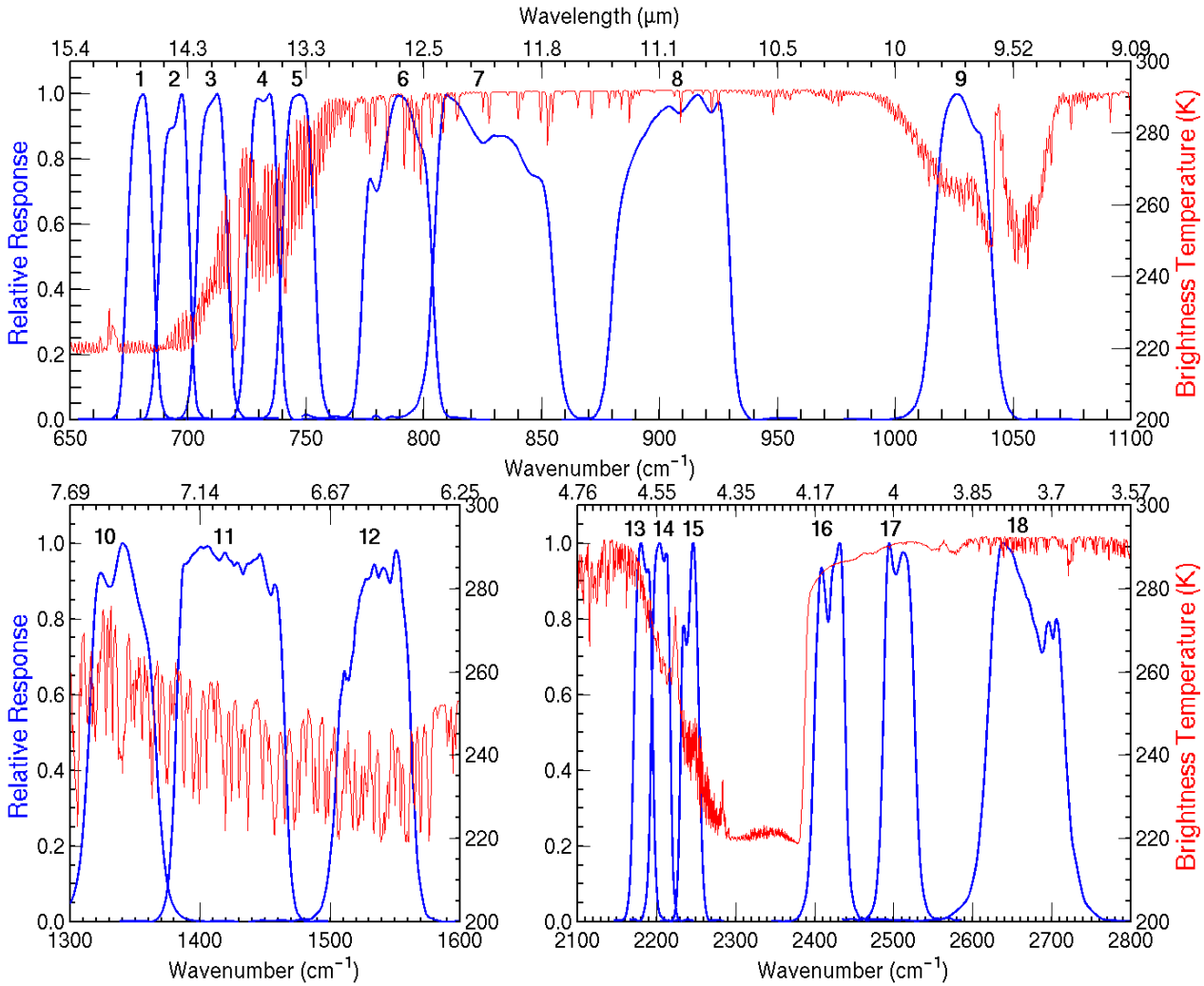


GOES Sounder Total Ozone



GOES Sounder Spectral Coverage

Current instrument has 18 infrared bands.

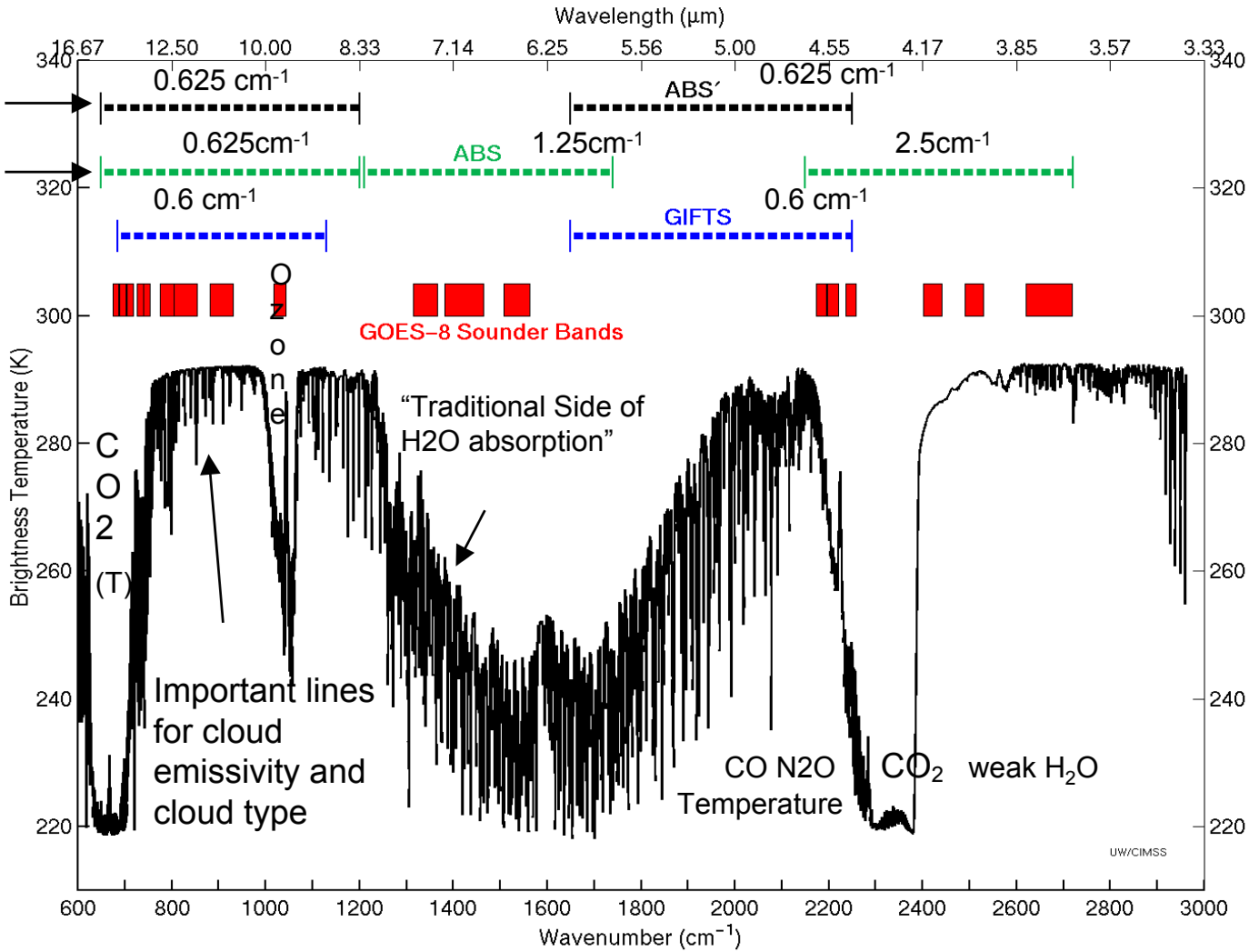


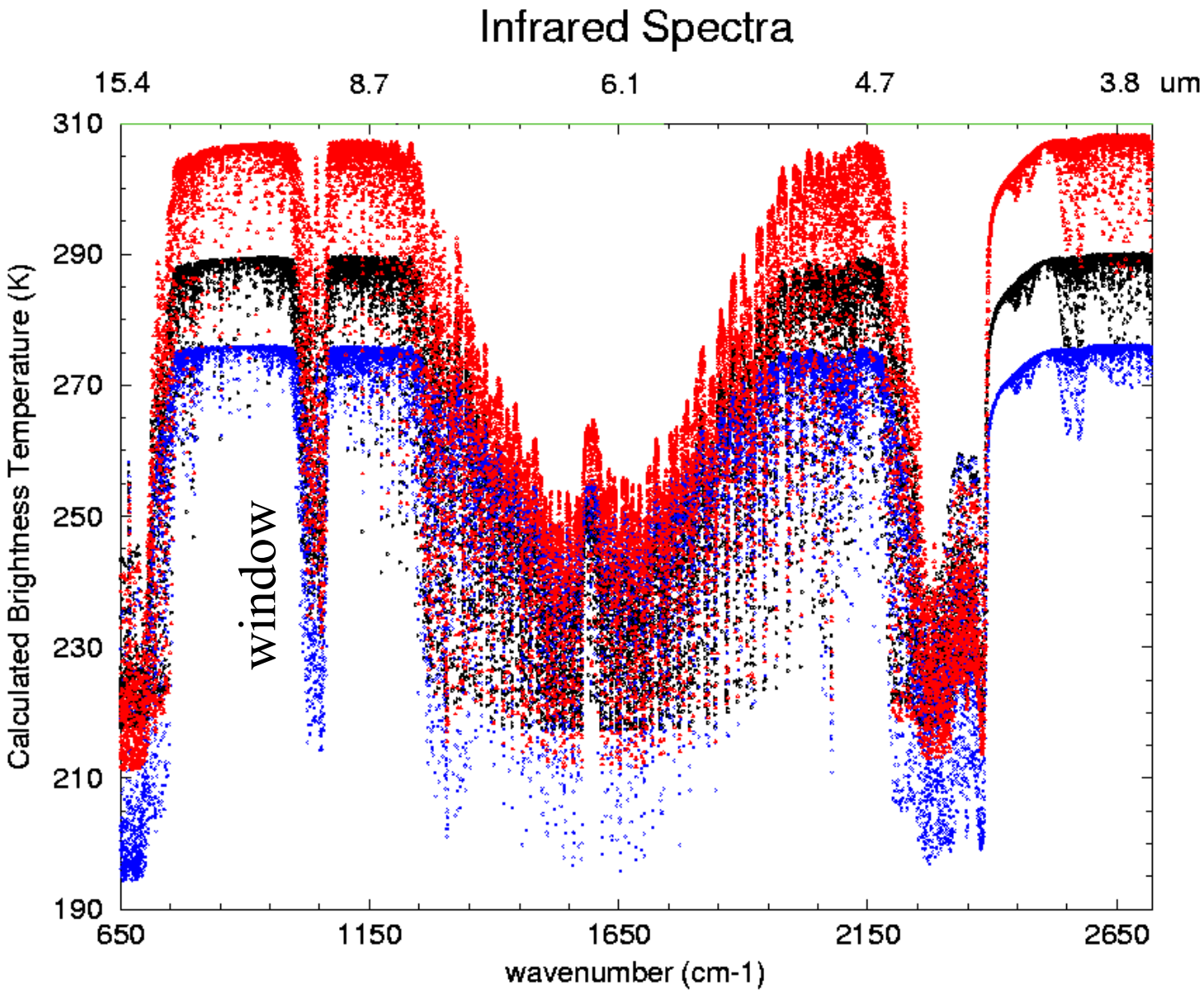
IR Spectral Coverage (DS or SW/M)

Example 1

Example 2

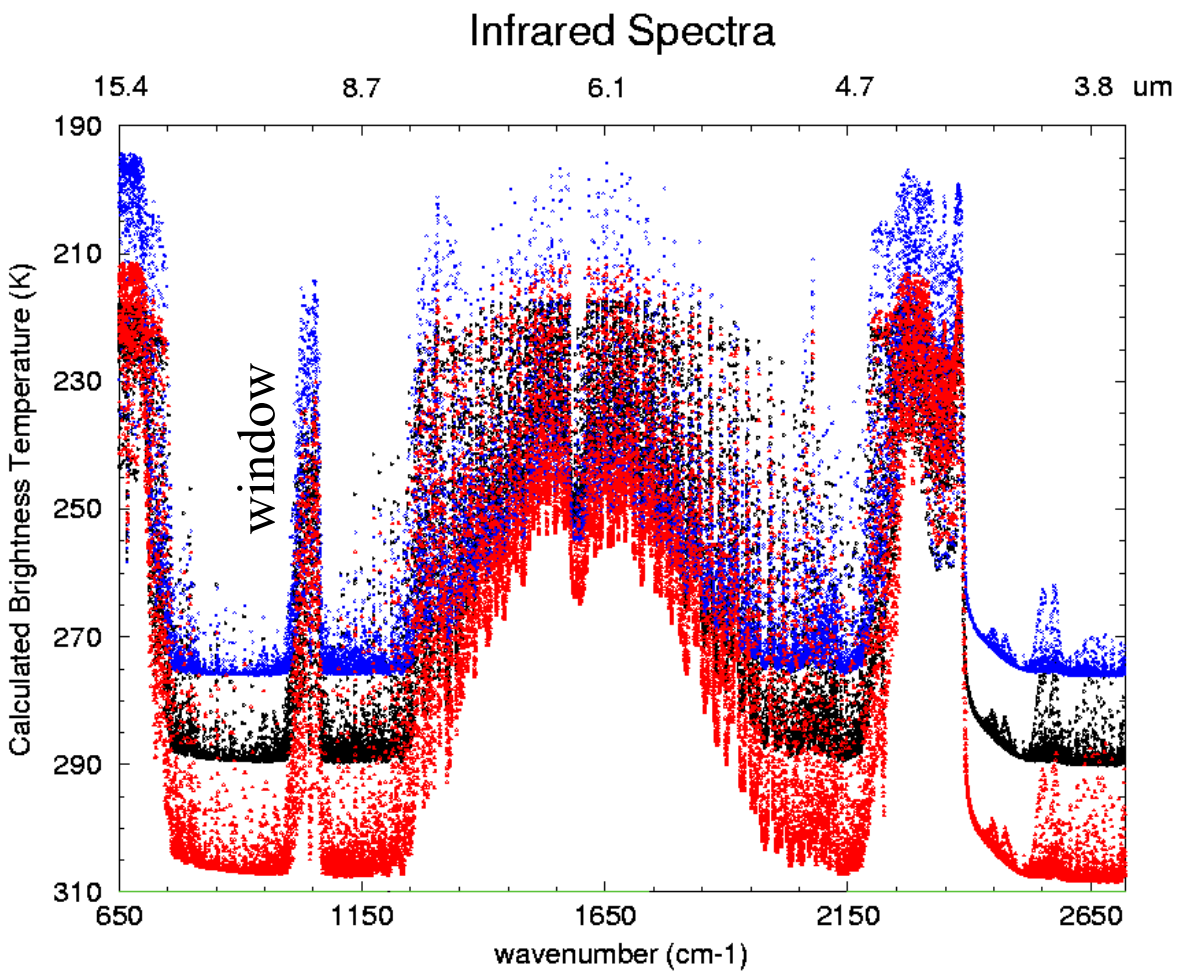
(Example 3 not shown)



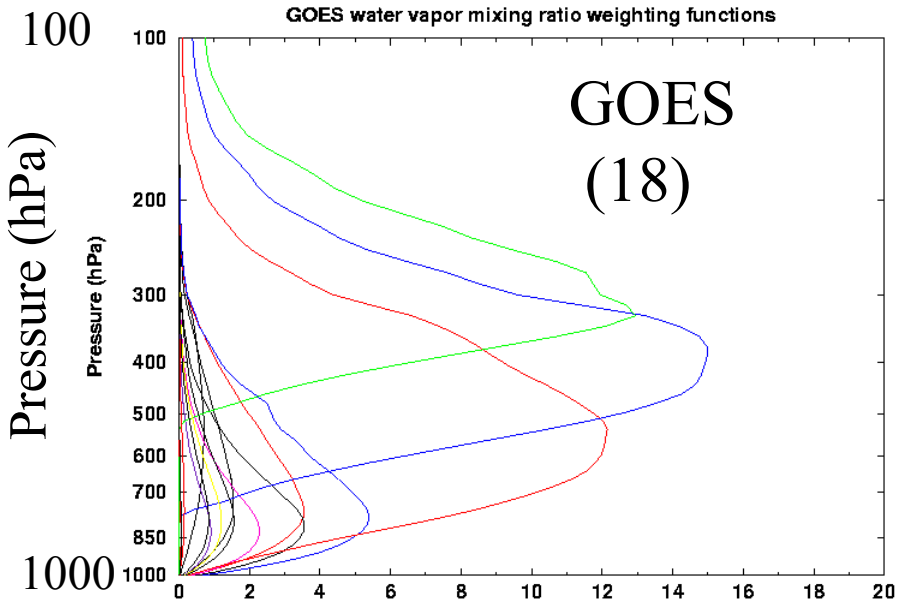


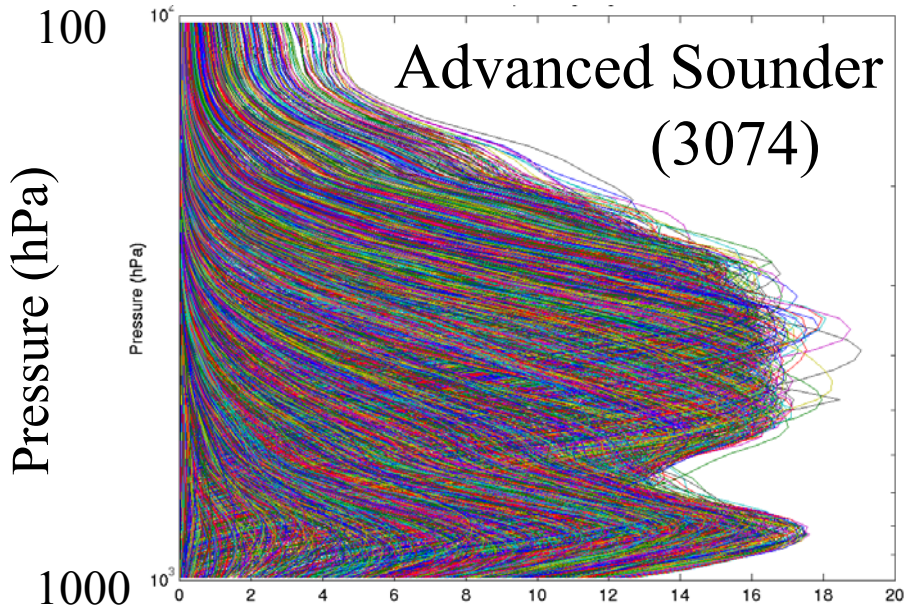
Spectra calculated (line-by-line) show the atmospheric variations of temperature and moisture.

Inverted TBB



Atm	Sfc Temp (K)	Sfc Moisture (gm/Kg)
Cold:	276	4
Warm/moist:	303	23
Hot/dry:	308	8

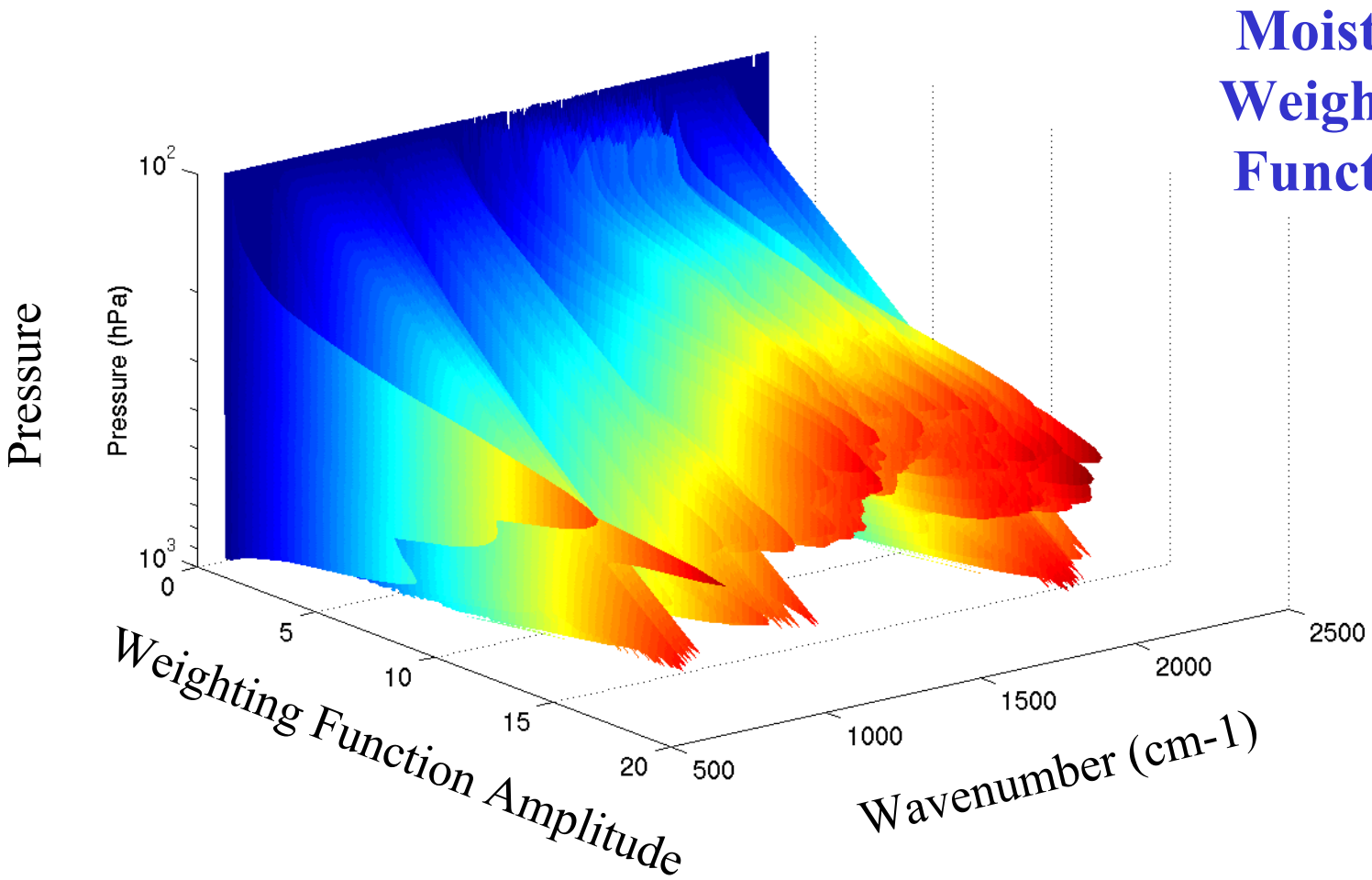




Moisture Weighting Functions

High spectral resolution advanced sounder will have more and sharper weighting functions compared to current GOES sounder. Retrievals will have better vertical resolution.

These water vapor weighting functions reflect the radiance sensitivity of the specific channels to a water vapor % change at a specific level (equivalent to dR/dlnq scaled by dlnp).

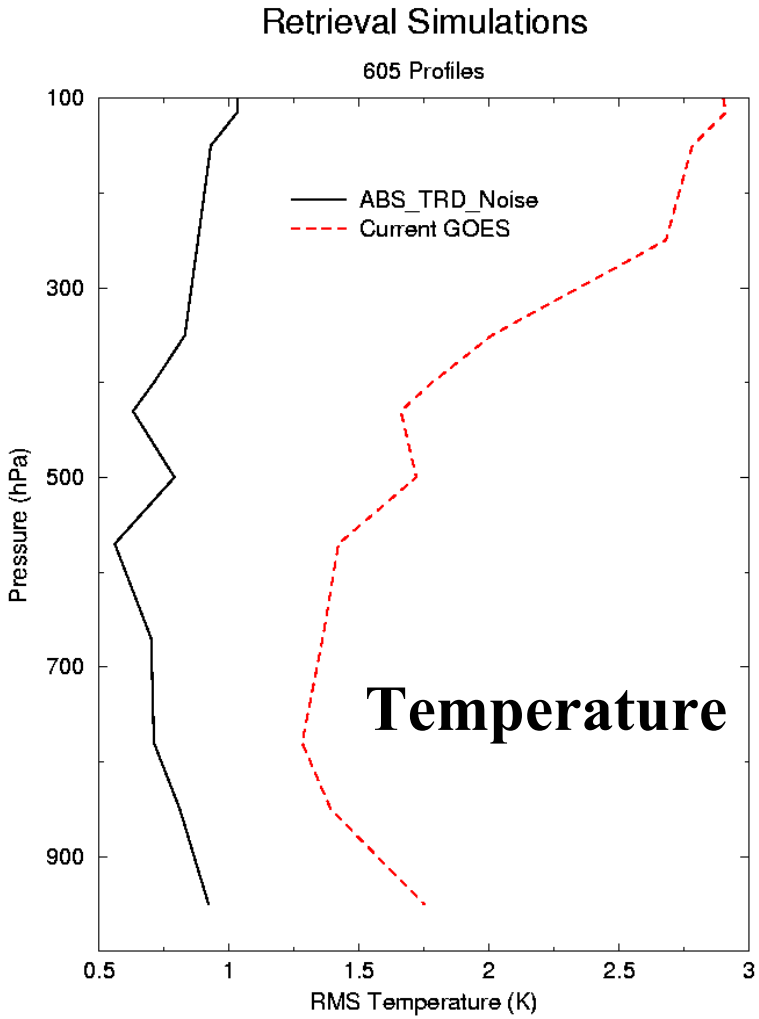


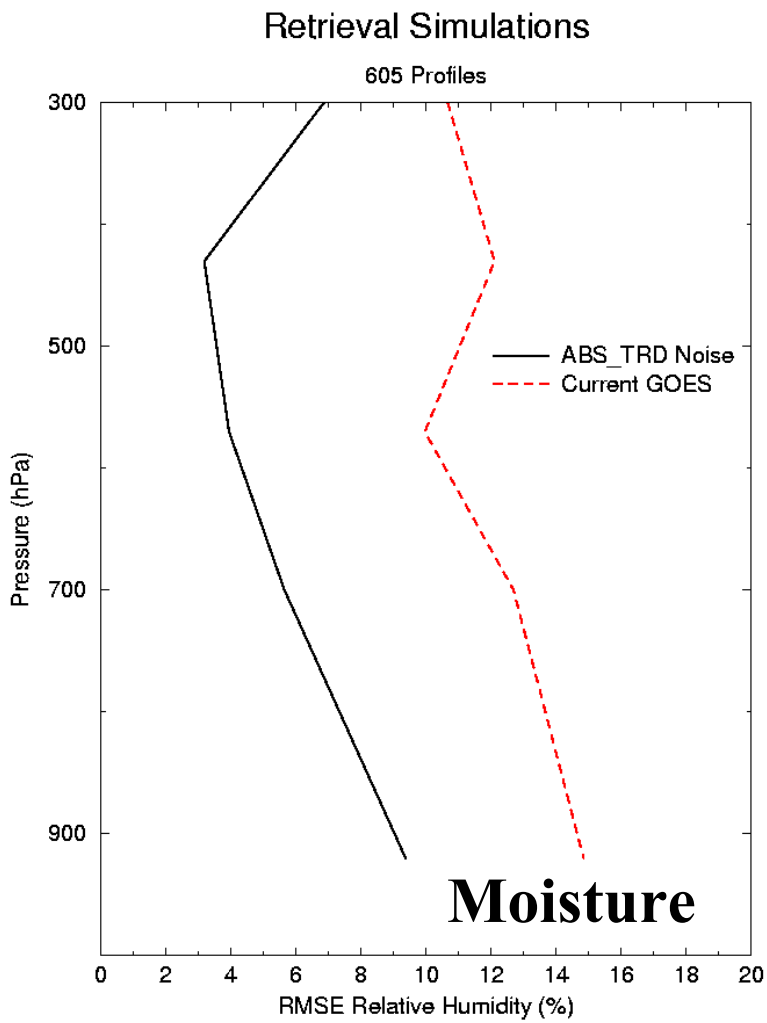
UW/CIMSS

The advanced sounder has more and sharper weighting functions

Simulations of Low vs High Spectral Resolution Retrievals

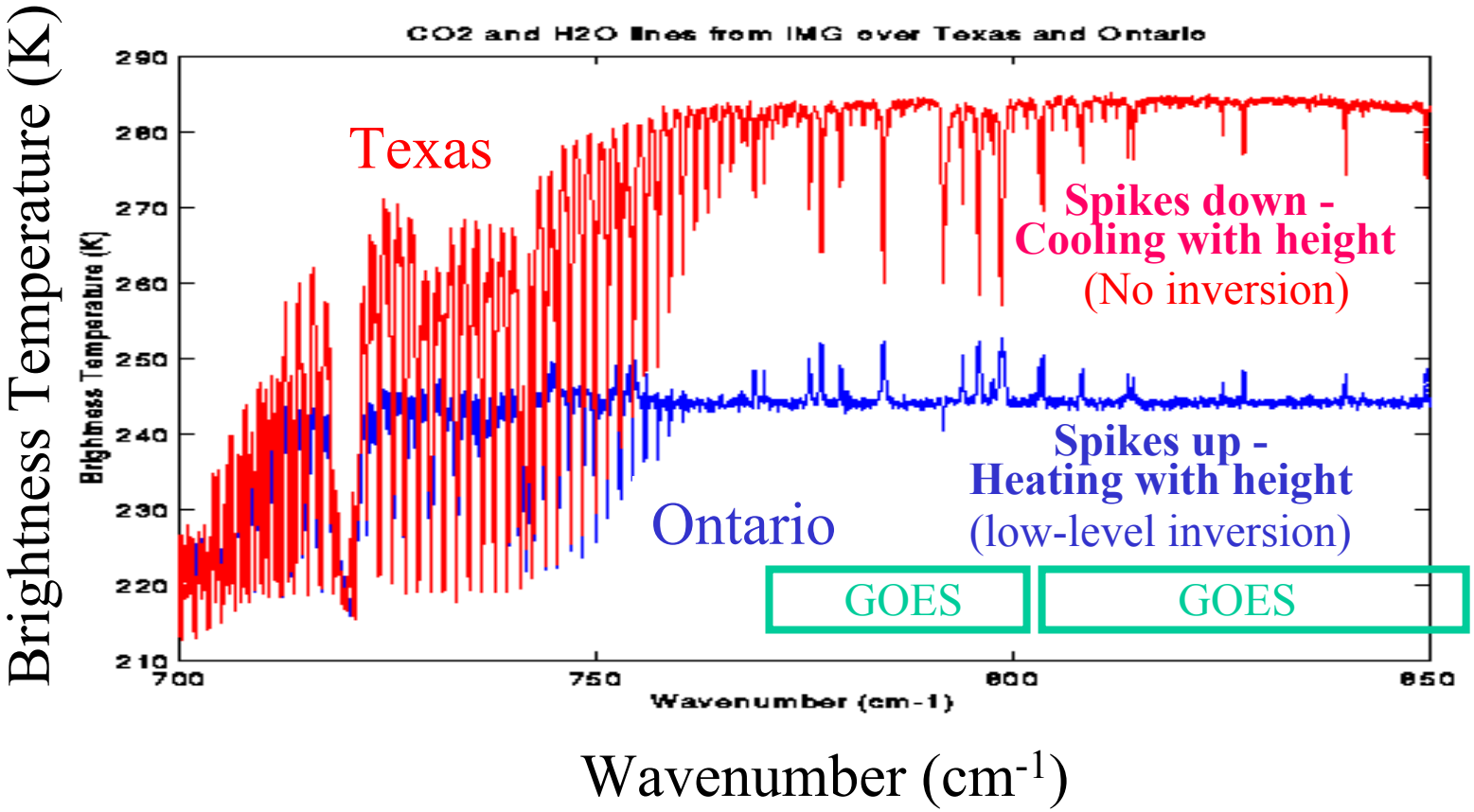
Geo-I gets <1 K rms for 1 km T(p) and <10% rms for 2 km RH(p)





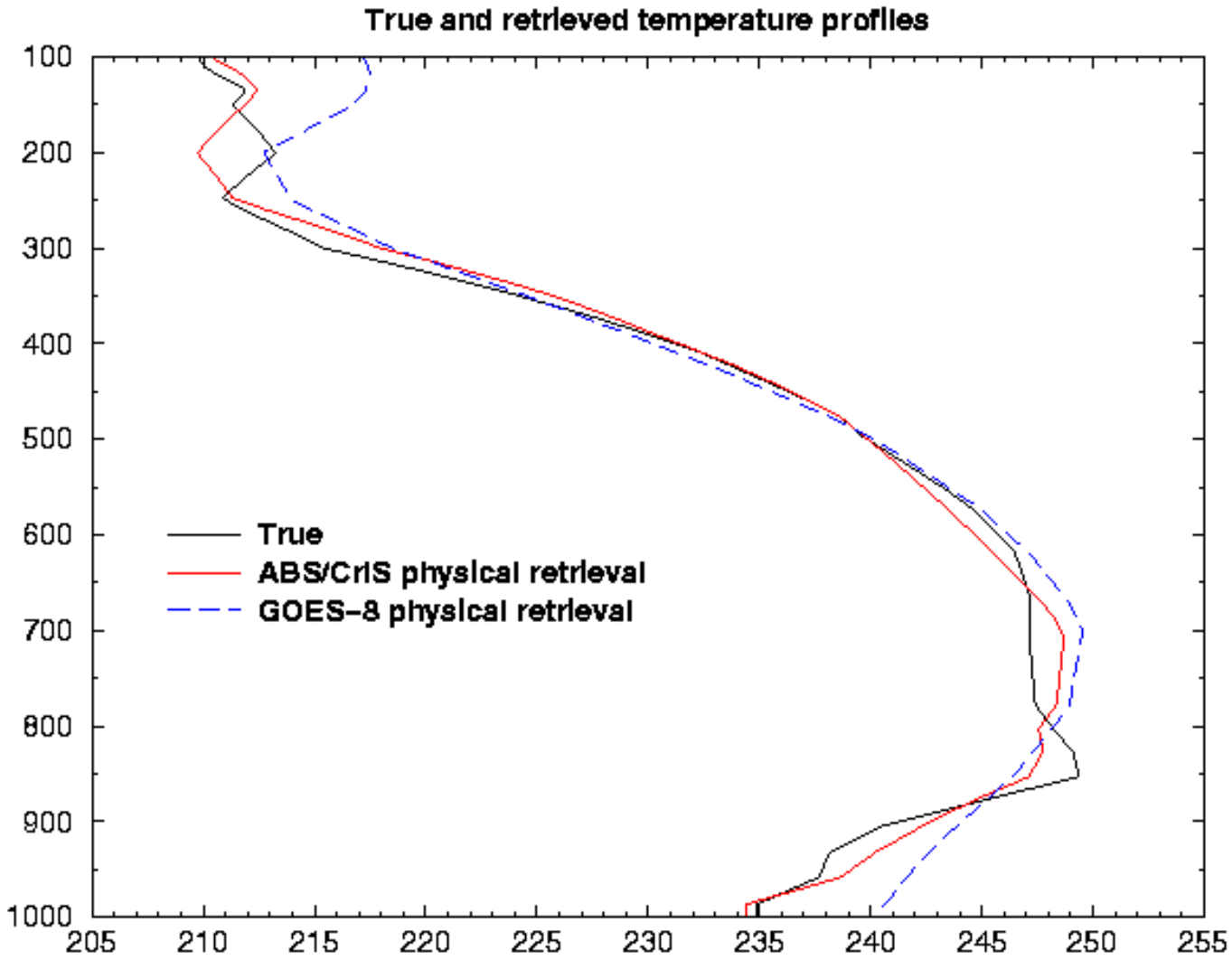
Strategy is (1) use all channels in a regression first guess and then (2) use sub-set of channels for physical retrieval

Detection of Temperature Inversions Possible with Interferometer

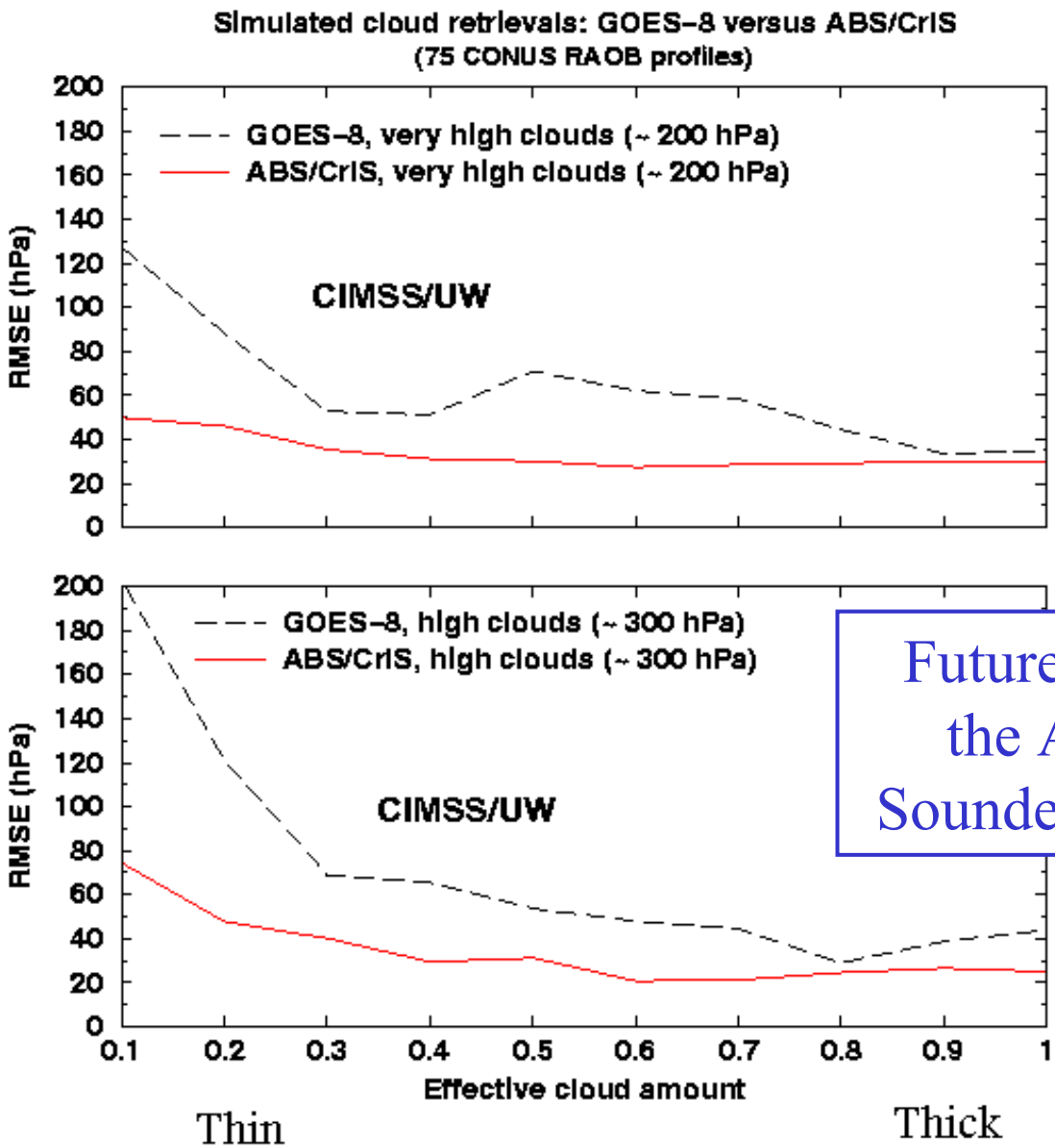


Detection of inversions is critical for severe weather forecasting. Combined with improved low-level moisture depiction, key ingredients for night-time severe storm development can be monitored.

ABS/CrIS vs GOES retrieval for low level temperature inversion



Cloud-Top Information



Future GOES -- simulating the Advanced Baseline Sounder (ABS) performance

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